NGFI architecture considerations

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Next Generation Fronthaul Interface - Use Cases & Scenarios			
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Background

Background

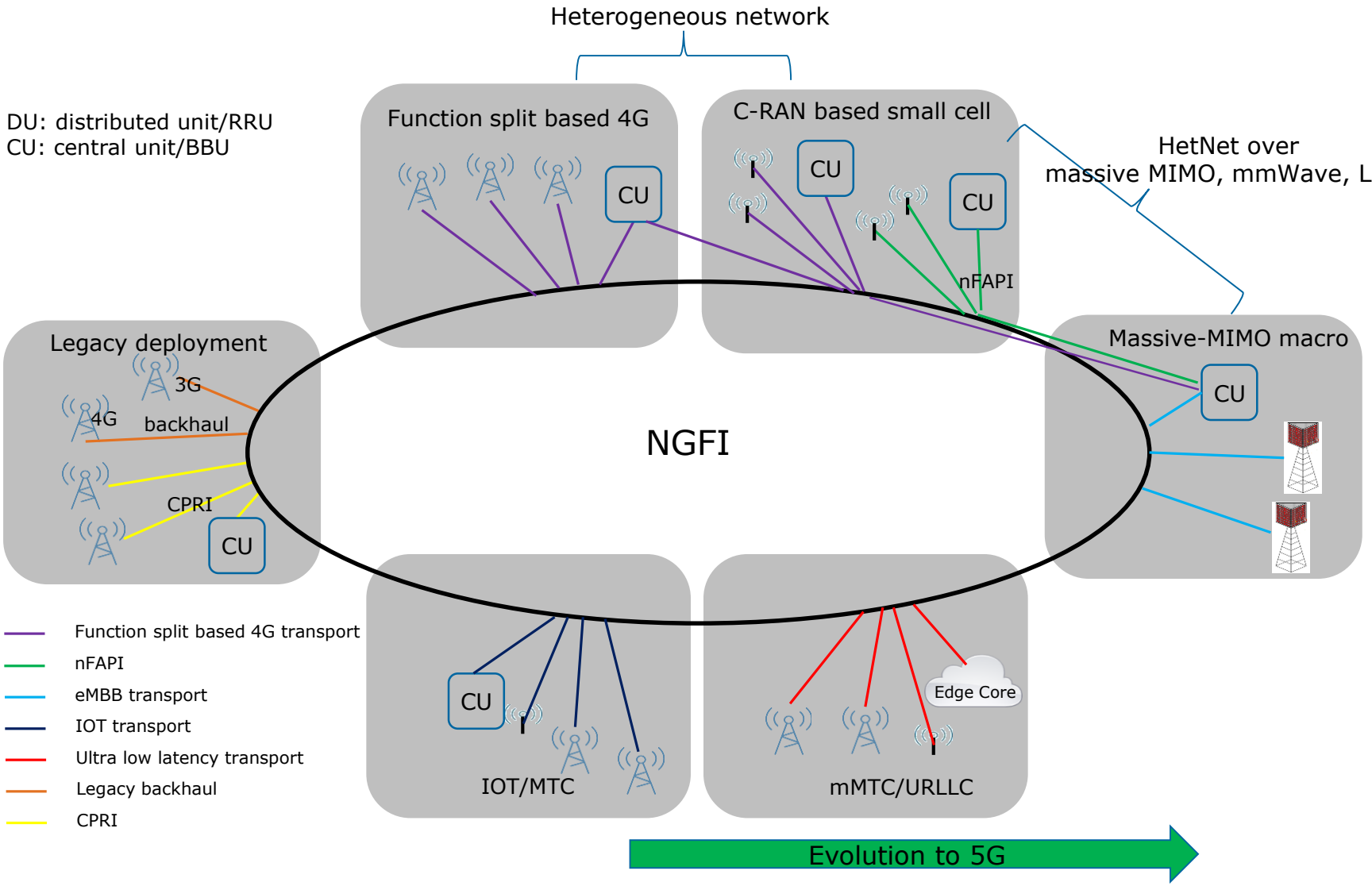
Last NGFI f2f meeting

- 1914.1 WG has agreed to a motion with the following key elements:
  - NGFI transport classes of service (COS) are defined according to priority, latency, and bandwidth criteria
  - Three main COS categories are assumed
    1. Control & management (RAN)
    2. Data-plane (RAN)
    3. Transport NW control & management (C&M)
  - Each category of COS may contain a number of sub-classes. Defining these sub-classes and associating them with specific class parameters (priority, latency, throughput, etc.) is for further study
- Discussions of high level NGFI architecture
  - Mainly around the multi-interface frame work proposal by [Korhonen]
  - Question raised whether a logical view of a converged/unified interface needs be explored

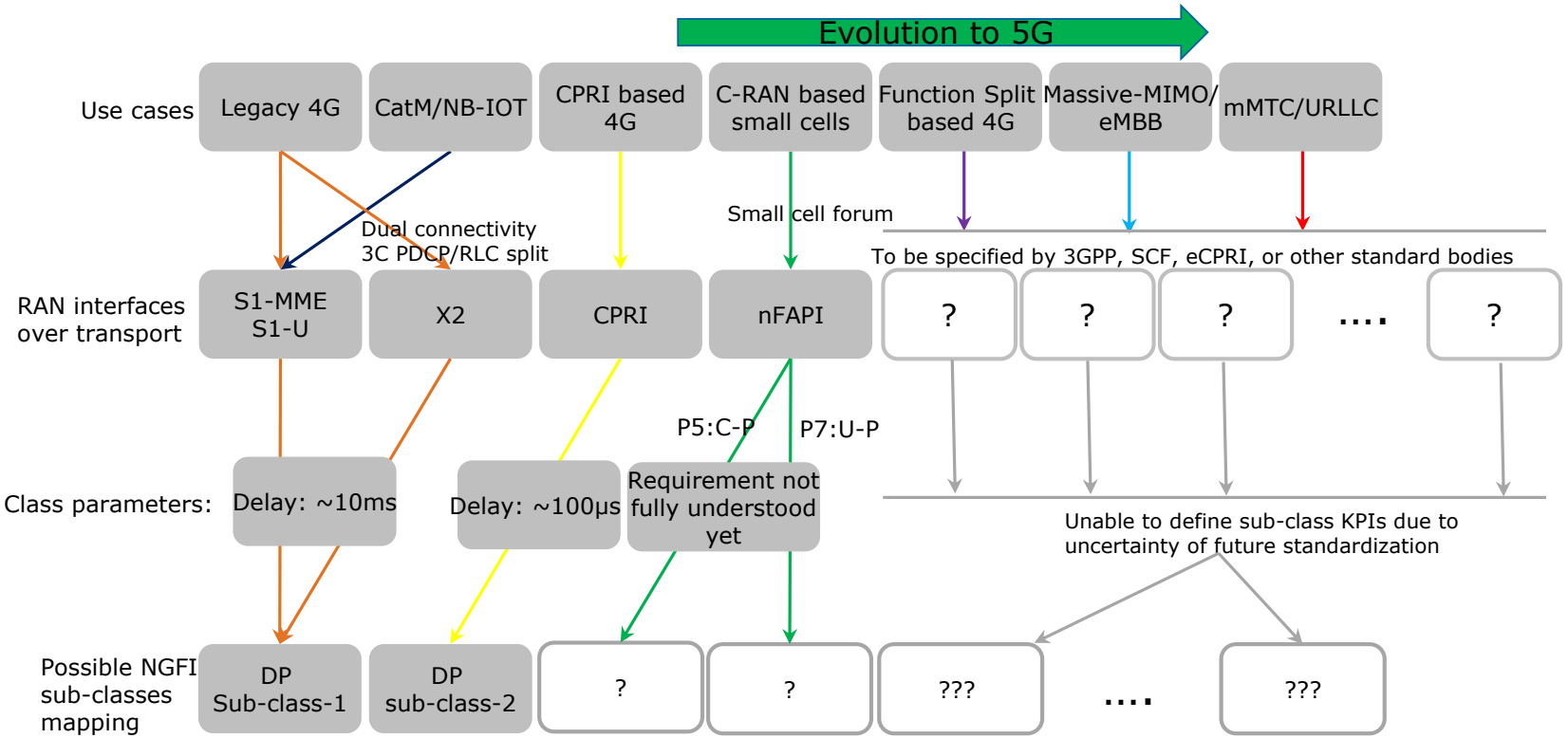
This contribution provides our views on these two topics, in considerations of the proposed use cases & scenarios.

Defining sub-classes

Recapture of NGFI use cases & deployment scenarios



Initial look at what could be done for sub-class definition



➔ Lots of unknown & uncertainties

Challenges NGFI is facing

- RAN interfaces are defined cross multiple standardization bodies (3GPP, SCF, CPRI, eCPRI, etc.). The possible future specifications may have large variations in terms of objectives and forms of transport requirement
- Data link layer of Ethernet/packet switch network is also evolving with new functionalities to adapt to 5G transport requirement (802.1CM, TSN, and MEF 5G Open CS, etc.)
- Function split, a dominant factor impacting transport requirement, has large number of options/sub-options. It is not clear in near future which ones will be standardized. Furthermore, it is likely standardization implementation for each of the selected options may be carried out in steps, spreading out to a long period.
- Transport latency requirement depends not only on standards but also on specific equipment implementations, another uncertainty factor not clear until the time of provisioning the deployment
- Large variation of transport throughput requirement is envisioned along the course of service deployment, where user data rate, signal bandwidth, and site dimensioning (number of sectors) etc. can vary significantly, so as the throughput requirement
- Transport latency variation (or jitter) requirement needs be further explored

Static approach of defining sub-class

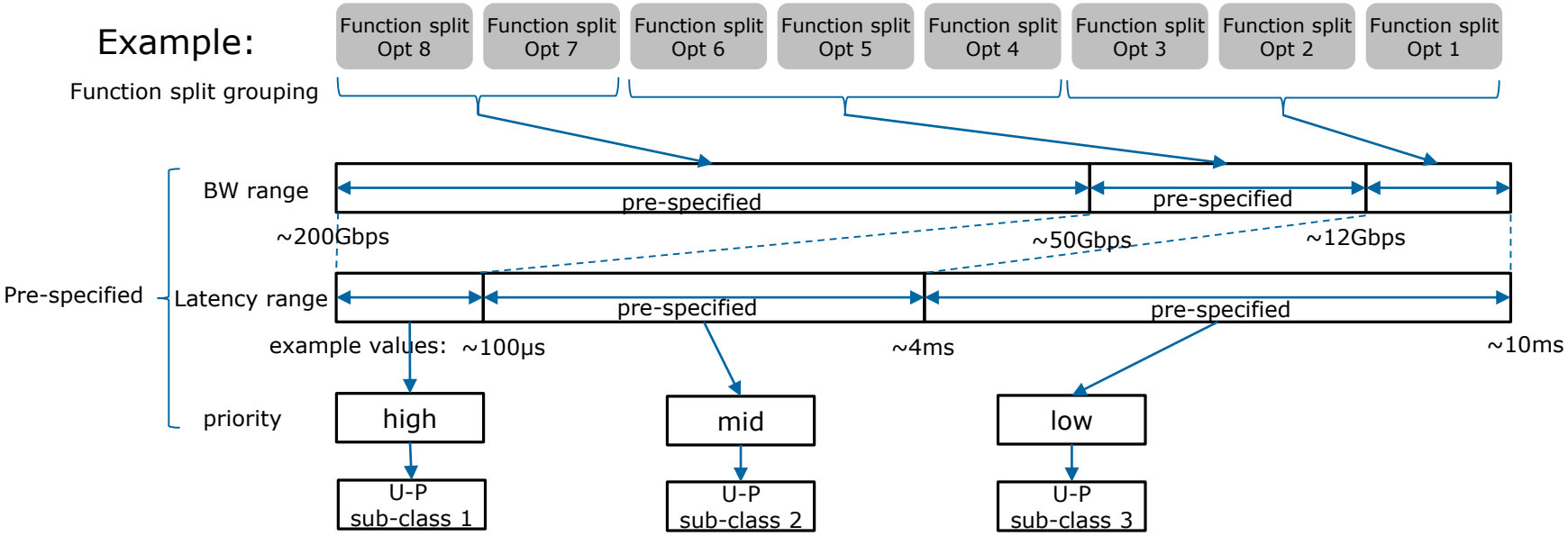
NGFI pre-specifies

- Function split grouping or class parameter ranges used for grouping
- Total number of sub-classes
- Sub-class priority

Limitations

- Creating a rigid transport NW architecture that may severely impact the flexibility/scalability of future service deployment
- Difficult to handle the challenges aforementioned

Example:



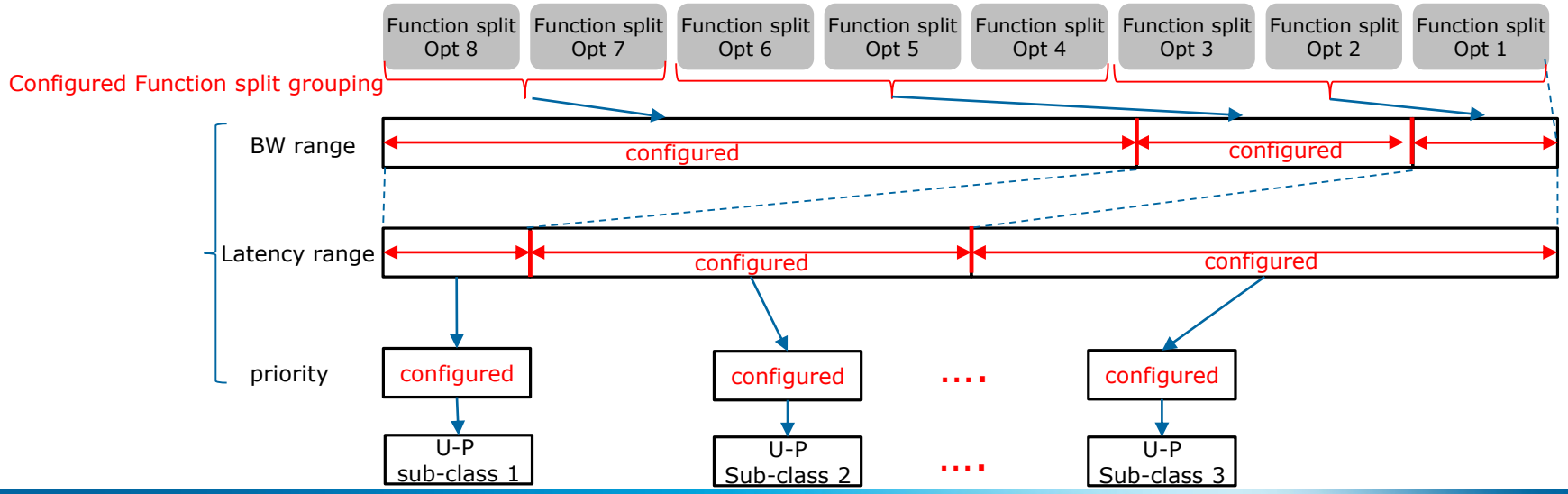
Proposal: configurable sub-classes

NGFI specifies

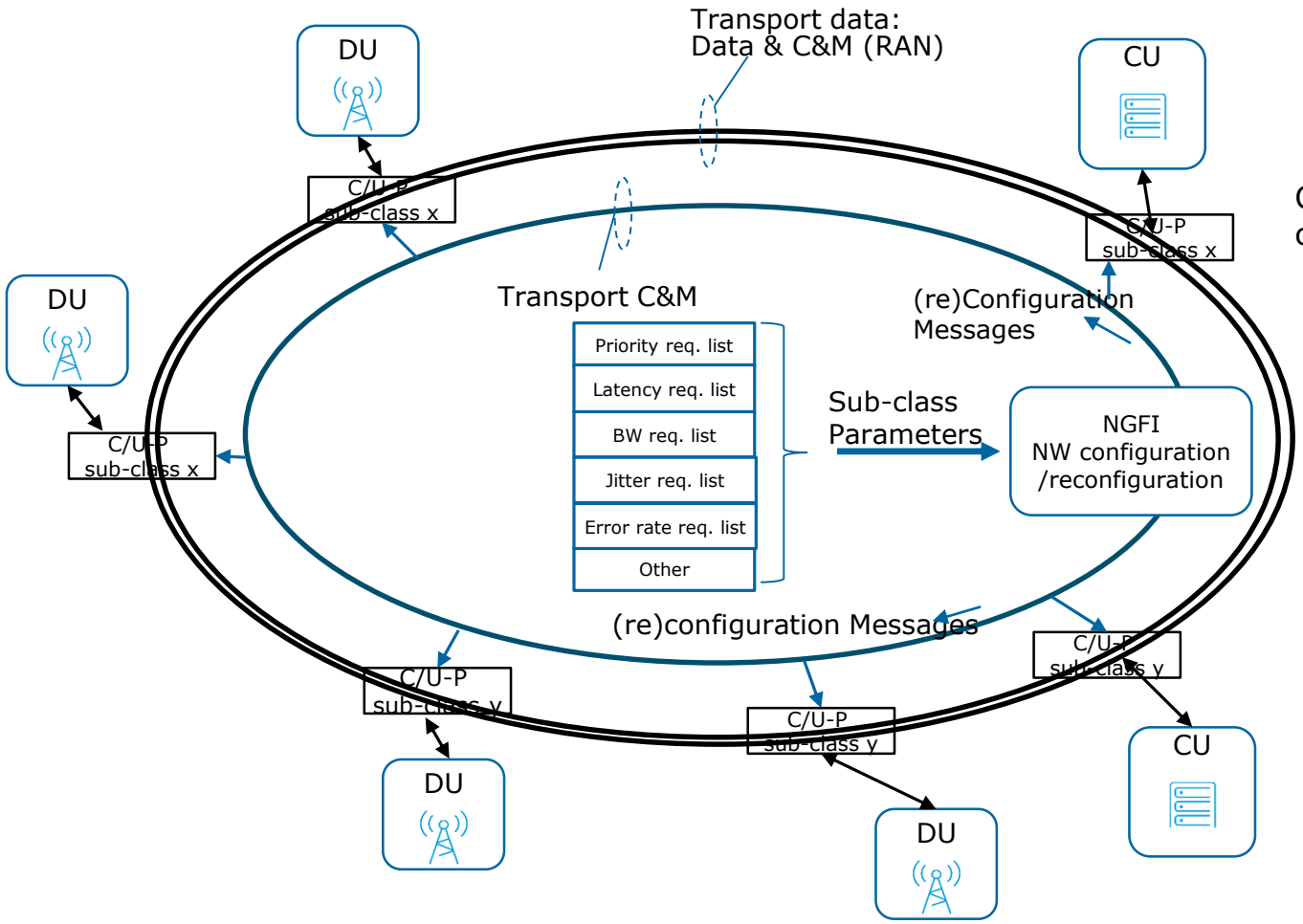
- A control/management mechanism that enables flexible configuration/reconfiguration of
  - Groups of function split
  - Total number of sub-classes
  - Class parameter ranges used for sub-class assignment
  - Priority level of each sub-class

Benefits

- Provide a future proof transport interface architecture
- Allow graceful migration on each stage of evolution from 4G to 5G
- Accommodate vast BW requirement variation on each stage of service deployment
- Allow dynamic or semi-dynamic switching of DU/CU pairs for data traffic balancing/offloading
- Possibly reuse some of exiting NW QOS elements



Architecture view of the sub-class configuration/reconfiguration



C/M mechanism for sub-class configuration/reconfiguration of:

- Total number of sub-classes
- Class parameter ranges
  - Latency
  - Transport BW
  - Jitter
  - Error rate
  - Other (should be flexible to include more criterions)
- Priority level of each sub-class
- Assignment of sub-class(es) to data traffics of each end-node (DU & CU pair)

Motion #1

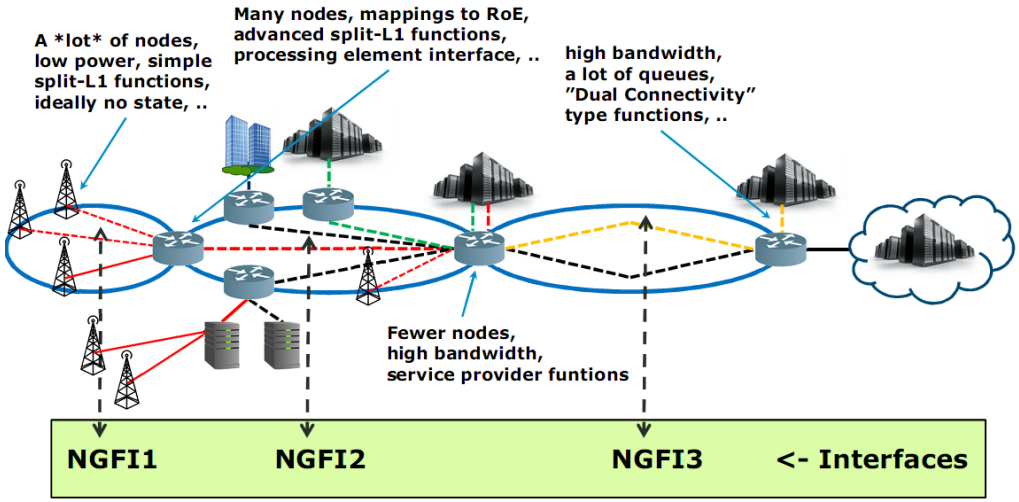
- Agree as a reference architecure model to establish a C&M mechanism in NGFI architure for specifying the sub-classes of COS, as described in slide 13 of tf1_1701_cai_tazi_architecture_considerations.pdf

- Mover: Abdellah Tazi
- Seconder:

- Yes: ___ No: ___ Abstain: ___ (technical motion needs >= 2/3)

NGFI architecture discussion

Recapture of NGFI architecture proposal from [1]



NGFI1: A lot of nodes with ~10-25G links
- Tight network sync requirements up to 12.5 ns …,
- End-2-end latency tens of microseconds,
- Network aggregated bandwidth up to Terabytes, …

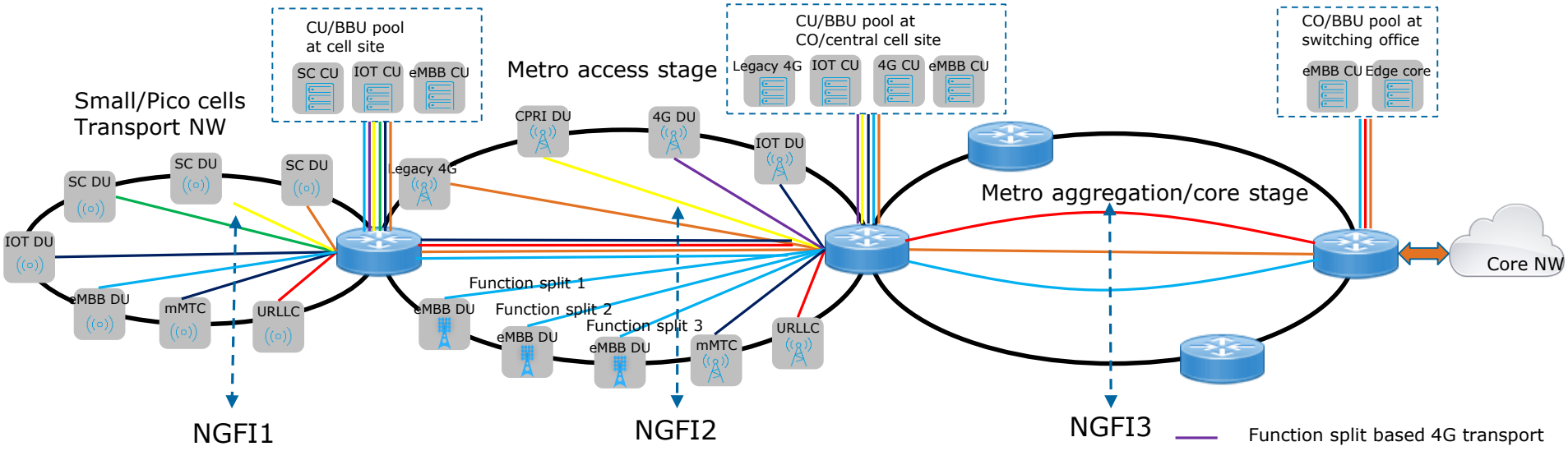
NGFI2: Many nodes up to 10G links up to close terabit scale
- Tight network sync requirements up to 12.5 ns …,
- End-2-end latency tens of microseconds,
- Network aggregated bandwidth in tens to hundreds of Giga bytes, …

NGFI3: fewer nodes; terabit scale, 100 G links
- Network sync requirements in backhaul class…,
- End-2-end latency measured in scales of millisecond,
- Network aggregated bandwidth in hundreds of Gigabytes, …

NGFI1,2,3 are defined as:
- Each to be located at different stages of aggregation in the packet switched NW
- Each to be mapped to a class of service
- Each associated with class requirement parameters: BW, latency, jitter, etc.

[1]tf1_1608_korhonen_practical_approach_2.pdf

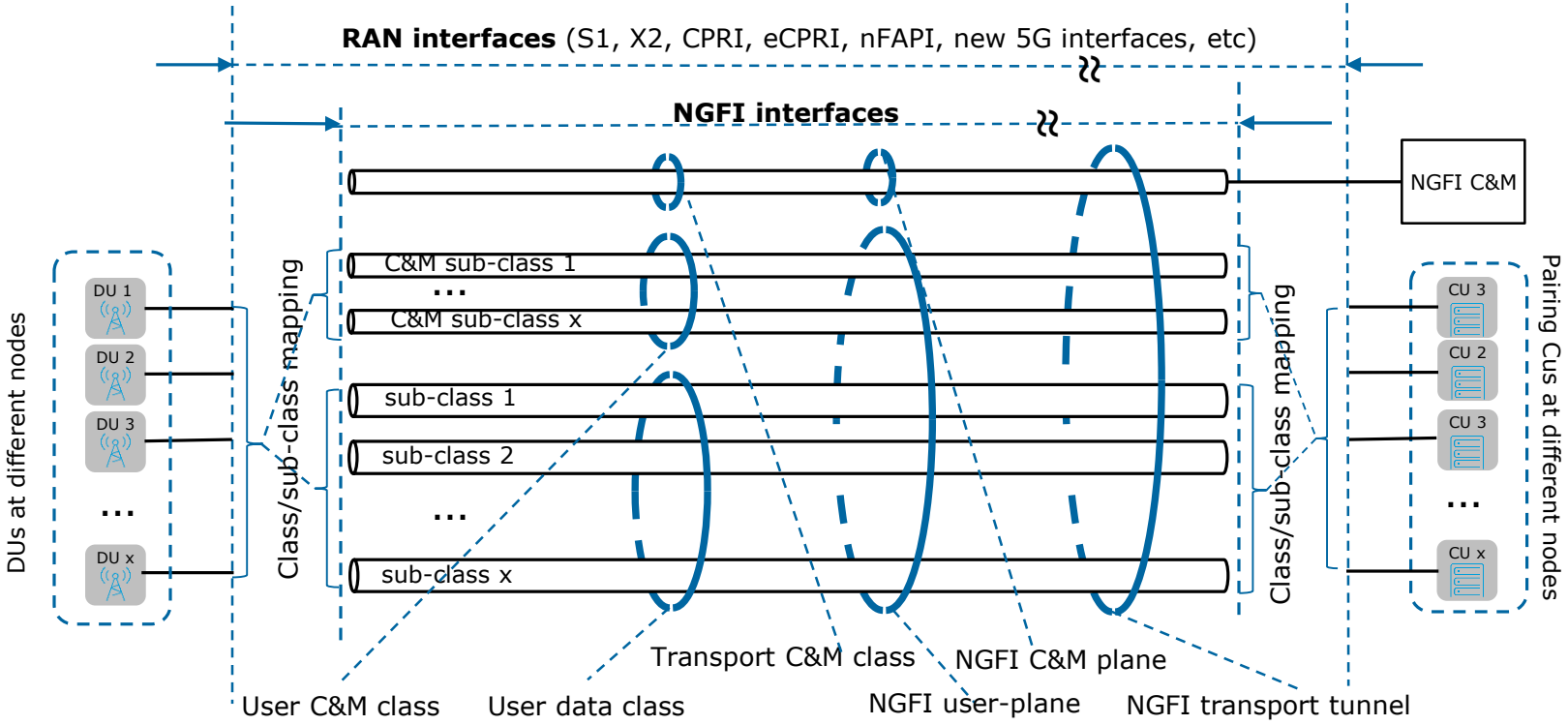
Practical consideration of the NGFI architecture



- Use cases are applied to the NGFI architecture proposed by [1]
- Incomplete effort, so possibly more scenarios may still be found
- CUs can be located at any aggregation stage/nodes in real deployment, creating complicated scenarios across the transport NW
- Possible CU/BBU pool switching for load balancing/pooling
- Various types of transport traffics (or COSs) incur at each stage of aggregation
- No clear relations of the NGFIs to the classes of services ➔ One interface (or COS) per stage of aggregation assumption doesn't seem to hold

➔ A converged & unified logical architecture description needs to be explored

Logical view of NGFI architecture



- NGFI bridges the packet switched NW with multiple existing/future RAN interfaces
- Described as a logical NGFI architecture based on class of service implementation
- Apply to any of logically linked DU/CU pairs located at any nodes in a packet switched network
- Merge all types of transport traffics to one NGFI tunnel that is managed by NGFI C&M unit
- Prioritize transport traffics base on class/sub-class assignment

Motion #2

- Agree as a reference model the high level logical NGFI architure described in slide 18 of tf1_1701_cai_tazi_architecture_considerations.pdf
- Mover: Abdellah Tazi
- Seconder:

- Yes: ___ No: ___ Abstain: ___ (technical motion needs >= 2/3)